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MACTEC ENVIRONMENTAL RESTORATION SERVICES, LLC

Spectral Gamma-Ray Borehole
Log Data Report

Log Event A

Borehole 30-11-01

Borehole Information

Farm : C	**Tank :** C-111	**Site Number :** 299-E27-63
N-Coord : 43,036	**W-Coord :** 48,441	**TOC Elevation :** 645.77
Water Level, ft :	**Date Drilled :** 2/28/1970	

Casing Record

Type : Steel-welded	Thickness, in. : 0.280	ID, in. : 6
Top Depth, ft. : 0	Bottom Depth, ft. : 100	

Borehole Notes:

This borehole was drilled in February 1970 and completed to a depth of 100 ft with 6-in.-diameter casing. The driller's log makes no mention of perforations or grouting; therefore, it is assumed that the casing is not perforated or grouted. The casing thickness is assumed to be 0.280 in., on the basis of the published thickness for schedule-40, 6-in. casing.

The top of the casing is the zero reference for the log. The casing lip is approximately even with the ground surface. The measured depth of the borehole was 98.6 ft.

Equipment Information

Logging System : 1B	**Detector Type :** HPGe	**Detector Efficiency:** 35.0 %
Calibration Date : 02/1997	**Calibration Reference :** GJO-HAN-13	**Logging Procedure :** P-GJPO-1783

Log Run Information

Log Run Number :	1	**Log Run Date :**	02/28/1997	**Logging Engineer:**	Alan Pearson
Start Depth, ft.:	0.0	**Counting Time, sec.:**	100	**L/R :** L **Shield :**	N
Finish Depth, ft. :	27.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

Log Run Number :	2	**Log Run Date :**	03/03/1997	**Logging Engineer:**	Alan Pearson
Start Depth, ft.:	26.0	**Counting Time, sec.:**	100	**L/R :** L **Shield :**	N
Finish Depth, ft. :	44.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

Log Run Number :	3	**Log Run Date :**	03/03/1997	**Logging Engineer:**	Alan Pearson
Start Depth, ft.:	43.0	**Counting Time, sec.:**	100	**L/R :** L **Shield :**	N
Finish Depth, ft. :	64.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

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Log Run Number :	4	**Log Run Date :**	03/04/1997	**Logging Engineer:**	Alan Pearson
Start Depth, ft.:	98.0	**Counting Time, sec.:**	100	**L/R :** L	**Shield :** N
Finish Depth, ft. :	63.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

Analysis Information

Analyst : H.D. Mac Lean

Data Processing Reference : MAC-VZCP 1.7.9 Analysis Date : 09/05/1997

Analysis Notes :

The SGLS log of this borehole was completed in four logging runs. A centralizer was used during all runs. The pre- and post-survey field verification spectra for three of the logging runs met the acceptance criteria established for peak shape and system efficiency. The post-survey field verification spectra for the first logging run failed the system efficiency criteria. The energy and peak-shape calibration that best matched the logging run data were used to establish the channel-to-energy parameters used in processing the spectra acquired during the logging runs. For the first logging run, these parameters were extracted from the pre-survey field verification spectra. There was negligible gain drift during the logging runs and it was not necessary to adjust the established channel-to-energy parameters to maintain proper peak identification.

Casing correction factors for a 0.280-in.-thick casing were applied during the analysis.

Cs-137 was the only man-made radionuclide detected in this borehole. Cs-137 contamination occurs continuously from the ground surface to a depth of 2.5 ft, almost continuously from 9.5 to 28 ft, intermittently from 32.5 to 56 ft, and at the bottom of the logged interval (98 ft). Except at the ground surface, the maximum Cs-137 concentration was just over 1 pCi/g at a depth of 11.5 ft. All other measured Cs-137 concentrations were less than 1 pCi/g. The measured Cs-137 concentration at the ground surface was approximately 30 pCi/g.

The logs of the naturally occurring radionuclides show that the K-40 concentrations increase to a higher background level between 38 and 69 ft and increase again to an even higher background below 69 ft. The Th-232 background also increases perceptibly below a depth of 69 ft.

An analysis of the shape factors associated with applicable segments of the spectra was performed. The shape factors provide insights into the distribution of the Cs-137 contamination and into the nature of zones of elevated total count activity not attributable to gamma-emitting radionuclides.

Details concerning the interpretation of data for this borehole are presented in the Tank Summary Data Reports for tanks C-111 and C-112.

Log Plot Notes:

Separate log plots show the man-made and the naturally occurring radionuclides. The natural radionuclides can be used for lithology interpretations. The headings of the plots identify the specific gamma rays used to calculate the concentrations.

Uncertainty bars on the plots show the statistical uncertainties for the measurements as 95-percent confidence

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intervals. Open circles on the plots give the MDL. The MDL of a radionuclide represents the lowest concentration at which positive identification of a gamma-ray peak is statistically defensible.

A combination plot includes the man-made and natural radionuclides, the total gamma derived from the spectral data, and the Tank Farms gross gamma log. The gross gamma plot displays the latest available digital data. No attempt has been made to adjust the depths of the gross gamma logs to coincide with the SGLS data.

Plots of the spectrum shape factors are included. The plots are used as an interpretive tool to help determine the radial distribution of man-made contaminants around the borehole.